stroke—trials or systematic reviews with just a few thousand patients may yield apparently significant but unreliable results. Instead, trials (or reviews) involving several thousands of patients will be required. A recent example that highlights this problem is the use of aspirin to prevent pre-eclampsia in pregnant women. A large randomised trial that comprised over 9000 women failed to show any clear benefit for aspirin,[19] whereas a previous systematic review of published trials that comprised only 394 women had suggested a significant reduction of 65% in the risk of pre-eclampsia with aspirin.[20] In general, therefore, we suggest that the premise "Don't Ignore Chance Effects" (DICE) always be kept in mind.

CEC has a Wellcome Trust training fellowship in clinical epidemiology; MJC is supported by the Imperial Cancer Research Fund; PAGS and JS are supported by a grant from the Medical Research Council. The present overview of DICE therapy was piloted at a seminar conducted by Professor C Warlow at McMaster University, Canada, which tested coin therapy (flipping coins).

We thank Dr J Godwin, Oxford, for his help in producing the figure.

PARTICIPANTS IN THE EDINBURGH STROKE COURSE

M Steiner (Gugging, Austria); M G Ceravolo (Ancona), F Chiodo-Grandi (Piazza) (Italy); M Correia, M Magalhaes, M Silva (Porto, Portugal); E Amayo (Edinburgh), R Campbell (Shropshire), Zheng-Ming Chen (Oxford), S Fowlie (Oxford), A Hussain (Bristol), R Hyatt (West Bromwich), I Lennox (Glasgow), J McCallion (Carluke), B J Martin (Glasgow), P J Martin (Loughborough), R Morse (Oxford), S Nyanissara (Oxford), S Pollock (London), S J Sawcer (Manchester), B Sharrack (Sheffield), S Thom (London), M Watt (Belfast), R Walker (Gosforth), S Winner (Oxford).

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Handedness and longevity: archival study of cricketers

John P Aggleton, J Martin Bland, Robert W Kentridge, Nicholas J Neave

Department of Psychology, University of Durham, Durham DH1 3LE
John P Aggleton, *senior lecturer*
Robert W Kentridge, *lecturer*
Nicholas J Neave, *research assistant*

Department of Public Health Sciences, St George's Hospital Medical School, London SW17 0RE
J Martin Bland, *senior lecturer*

Correspondence to:
Professor Aggleton, School of Psychology, University of Wales, College of Cardiff, PO Box 901, Cardiff CF1 3YG

BMJ 1994;309:1681-4

Abstract

***Objective*—To test whether handedness is associated with a change in longevity.**

***Design*—Archival survey.**

***Setting*—British Isles.**

***Subjects*—All first class cricketers born before 1961 whose bowling hand was specified (right, n=5041; left, n=1132) in a comprehensive encyclopaedia.**

***Main outcome measures*—Bowling hand and life span.**

***Results*—Regression analysis of the 5960 players born between 1840 and 1960 (3387 dead, 2573 alive) showed no significant relation between mortality and handedness (P=0·3). Left handedness was, however, associated with an increased likelihood of death from unnatural causes (P=0·03, log hazard 0·37, 95% confidence interval 0·04 to 0·70). This effect was especially related to deaths during warfare (P=0·009, log hazard 0·53, 0·13 to 0·92).**

***Conclusion*—Left handedness is not, in general, associated with an increase in mortality.**

Introduction

Several reports have suggested that left handedness is associated with a reduction in life expectancy[2-5] and an increased likelihood of serious accidents.[5,6] These claims have, however, proved highly contentious.[7-11] One important criticism is that the longevity studies have been based on comparisons of age at death,[3,5,12,13] which is potentially misleading.[14,15] This is because such comparisons do not include information on those subjects who are still alive.[15]

The omission of information on survivors is a particular problem if there are fluctuations in the proportions of left and right handed people in the population. In fact, more tolerant attitudes have resulted in a gradual increase in the proportion of left handed people during this century.[7] There are therefore relatively few left handed elderly people (as many were forced to switch hands), but more left handed people among younger groups. Any comparison using the average age of death in 1994 is likely to come to the spurious conclusion that left handers die younger because it is weighted by the preponderance of elderly right handed people.[7,14] We therefore re-examined the potentially important claim of a difference in the mortality of left and right handed people by using analytical techniques that avoid these problems.

We examined the lifespans of left and right handed cricketers. Cricket has been thoroughly documented, and information about leading players extends back over 200 years. Furthermore, bowling provides an

unambiguous measure of handedness because it is extremely rare for a player to bowl successfully with both the left and the right hand. Bowling (or throwing) a ball is a good predictor of handedness,[16 17] and the precision required makes it unlikely that proficient bowlers would learn to use their non-preferred hand. Indeed, throwing hand is relatively insensitive to cultural pressure,[18] and the strategic value of left handed bowlers is well recognised, making it less likely that left handers might be forced into learning to bowl right handed. A final advantage of this measure is that the handedness of all of the subjects was assessed at a similar age, thus ruling out any effect associated with a gradual switch in handedness with increasing age.[9]

Subjects and methods

All data came from the second edition of the *Who's Who of Cricketers.*[1] This book describes all first class cricketers in the British Isles from 1864 to 1992 plus some of the more prominent earlier players. Data on deceased players were included only if their bowling hand was specified (n=3599). We also added those players described as bowling "off break," "leg break" or "leg break googly" as these terms are restricted to right handed players. Batting hand (the lower hand on the handle of a bat) was ignored as many right handed players bat left handed and vice versa.[17]

We noted birth and death dates for all subjects. For those players born or dying in England and Wales these dates had been confirmed by the book's authors with the General Register Office, London. When the book recorded the cause of death (because it was unusual or the player was young) this was also noted. In addition to those specified as being killed in action during the World War we noted a further 33 subjects who were presumed killed in action. These players consisted of those in a roll of honour of first world war deaths[19 20] and those whose location and date of death identified them as a soldier in a battle area.

The year of birth and bowling hand were also recorded for a further 2574 players born before 1961 but still alive at the time of the book's publication (1993). Four players who could bowl with either hand were excluded. The overall total of 6173 subjects (5041 right handed, 1132 left handed) constituted about 57% of all of the cricketers listed in the book who were born before 1961.

STATISTICAL ANALYSIS

We used the Cox regression technique to compare data on left and right handed players.[21] We excluded those born after 1960 since only one had died (a left handed player in an accident) and those born before 1840 because the number of cricketers in each birth year group was small. Lifespans were also compared with a two tailed t test, and associations between categorical variables analysed with the χ^2 test.

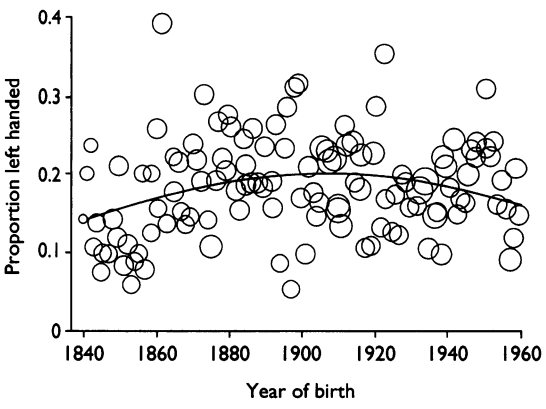

FIG 1—*Proportion of left handed players for each birth year between 1840 and 1960. Sizes of circles reflect numbers of subjects in each year group*

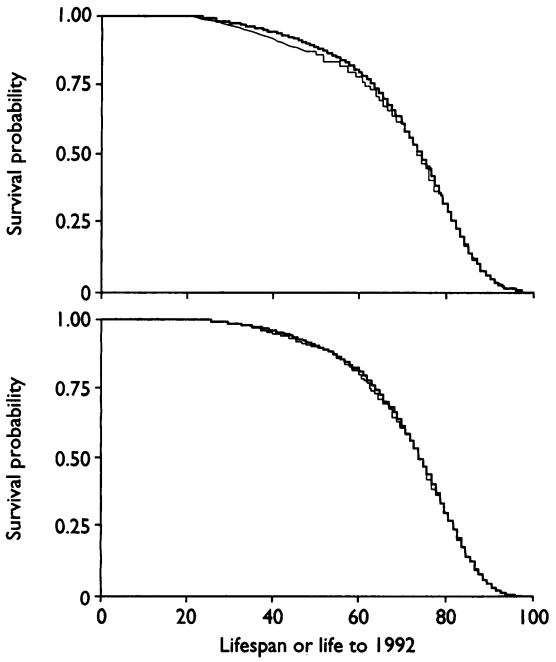

FIG 2—*Survival curves for cricketers born during 1840 to 1960: all subjects (top) and excluding those who died in accidental deaths (bottom)*

Results

The sample of 3599 deceased players comprised 663 left handed bowlers and 2936 right handed bowlers (18·4% left handed). Of the 2574 still alive, 469 were left handed and 2105 right handed (18·2% left handed).

We used the Cox regression analysis for data on the 5960 players born during 1840 to 1960, of whom 2573 were still alive and 3387 were dead. Logistic regression of the proportion of left handers in each birth year showed no evidence of a linear relation (fig 1), but when a year squared term was added the relation between prevalence of left handedness and birth cohort became significant ($P<0·02$). The relation between life expectancy and birth year was unlikely to be linear so we included a quadratic term for year of birth in the Cox regression. The appropriateness of this term was confirmed in a set of regression analyses in which the data were stratified by birth year, into six 20 year groupings starting from 1840. This produced almost identical results with those obtained with the quadratic correction for year of birth.

When year of birth was controlled for, no relation was found between handedness and mortality ($P=0·3$). The risk of death was increased only slightly for left handed cricketers (log hazard 0·05 (95% confidence interval −0·04 to 0·13); fig 2). The relative risk of death for left handed players at any time was increased by a factor of between 0·96 and 1·14. As the youngest age of death was 19 no meaningful comparisons could be made before that age.

A Cox regression analysis focusing on deaths in accidents or in action (including presumed killed in action) in which all other deaths were censored showed a significant relation between handedness and lifespan after year of birth was controlled for ($P=0·03$). The risk of death increased for left handed subjects, the log hazard being 0·37 (0·04 to 0·7). This corresponded to an increase in the relative risk of death of between 1·04 and 2·01. Analyses restricted to those killed or presumed killed in action were also significant ($P=0·009$). The log hazard was 0·53 (0·13 to 0·92), with the relative risk of death increased for left handers by a factor of between 1·14 and 2·51.

When those who died in accidents or in action were

excluded from the analysis no relation was found between handedness and lifespan (P=0·6), the log hazard being 0·02 (−0·07 to 0·11). The relative risk of death for left handed players increased by a factor of only 0·94 to 1·12 (fig 2).

We also tested the assumption that the hazard ratio for left handedness was constant by using age as a time dependent covariate. If this variable interacts with handedness the assumption of a proportional hazard for left handedness is incorrect because the hazard ratio changes with age. Age at death was divided into three groups (<45, 45-64, ≥65) and the interaction with handedness was represented in the regression by two dummy variables because there were three groups.

When this analysis was applied to all deaths the interaction between age and handedness was significant (χ^2=10·14, df=2; P<0·01). The estimated hazard ratio was 1·47 for those under 45 but 1·00 in those aged 45-64 years and 0·98 in those ≥65. The interaction with age is probably due to the effect of deaths in action, which comprised 27% of the 429 deaths below age 45. We therefore repeated the analysis including only deaths from natural causes. The interaction became non-significant (χ^2=1·39, df=2; P=0·5). Thus for deaths from natural causes the proportional hazards assumption fits the data well and there is no effect of left handedness with age. Though the risk of death was increased for young left handed cricketers (fig 2), this could be accounted for by those killed in action or in accidents.

A final series of analyses focused on the cause of the premature deaths. These analyses were based on all the dead cricketers, including those born before 1840 and the one player born after 1960 (n=3599). The mean lifespan was 64·7 (SD 17·4) years for the left handed players and 66·6 (SD 16·3) for the right handed players (difference=23 months, $t_{(3597)}$=2·73, P=0·006, fig 3). A similar difference was found for those players born between 1840 and 1960 (n=3387) even when year of birth was adjusted for (P<0·005).

Of the 3599 deceased players, 158 had died of unnatural causes (including transport accidents, drownings, and killed in action but excluding suicide). Of these 42 were left handed and 116 right handed. The proportion of left handers (26·6%) dying of unnatural causes was significantly higher than the 18·4% in the overall population of deceased players (χ^2=7·32, P<0·01). This difference increased when the 33 players who were presumed killed in action were included in the sample (χ^2=9·20, P<0·005). Though the proportion of left handed cricketers killed or presumed killed in action was relatively high (5·4% (36/663) left *v* 3% (88/2936) right; χ^2=9·07, P<0·003), the proportion of those dying in accidents in the remaining population did not differ (15 left *v* 52 right; χ^2=0·60). Finally, when the lifespans of the left and right handed groups were compared after removal of all 191 players known or presumed to have died of unnatural causes, the mean lifespan difference was reduced to 8·1 months ($t_{(3407)}$=1·01; P>0·05).

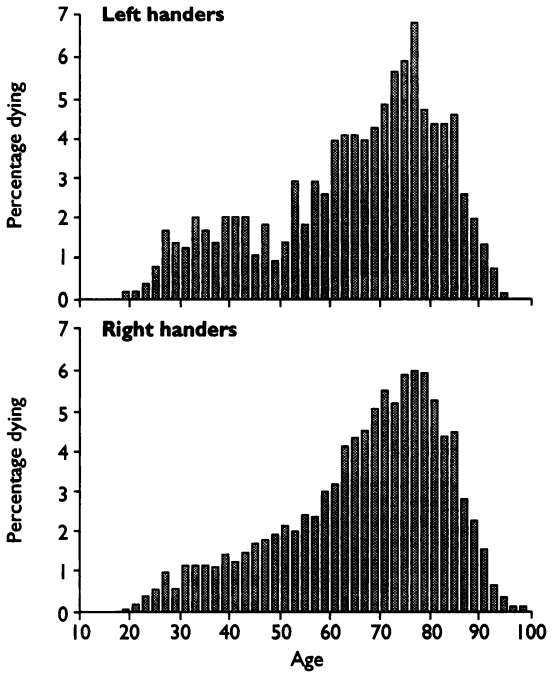

FIG 3—*Age at death of left handed (top) and right handed (bottom) cricketers*

Discussion

Our study of 6173 adult men provides a rigorous and extensive analysis of archival data on survival. It highlights the problems that can arise if mean age at death is used as the sole measure of longevity. The regression analyses found no overall difference in the survival curves of the left and right handed cricketers despite apparently different mean ages at death.

The increased risk of death in younger left handed cricketers (<45) seemed to reflect a higher proportion dying of unnatural causes, mainly during warfare. When unnatural deaths were excluded the survival curves for the left and right handed cricketers were similar (fig 2). These results indicate that unless the incidence of such deaths is unusually high there should be no overall difference between left and right handers.

The impact of unnatural deaths was much greater in the analyses based on age of death than in those using survival analyses. This is because many extant cricketers were included in the survival analyses, diluting the impact of those who died in the wars. Similarly, as most of the unnatural deaths occurred during the world wars the mean difference in age at death between the left and right handed people will gradually diminish as the size of the overall sample increases. This prediction is supported by the drop from 25 to 23 months in the mean difference in lifespan between left and right handed cricketers since 1984.[3]

A study of left handed baseball players (as defined by both throwing and batting hand) claimed that they did not live as long as their right handed counterparts.[5] Subsequent reports on baseball players that used various analyses of age at death, however, failed to replicate this finding.[12,13] Our results, which are based on more appropriate analyses and a greater number of subjects, further support the case against a general association between earlier death and left handedness.

Our findings leave unanswered the intriguing issue of why left handed players should have been more susceptible to unnatural deaths and, in particular, deaths during warfare. Though the proportion of left handed players increased slightly before the war years (fig 1), the increase is not sufficient to explain the results. The difference remained significant after year of birth was adjusted for. It seems, therefore, that left handed people may face particular disadvantages during warfare, perhaps because equipment and training are designed for right handed people. Our findings for other forms of accidental death are less clear as they are based on small sample sizes. Although it has been suggested that left handed people are more prone to serious accidents,[6] this claim has been challenged.[11]

CONCLUSIONS

In summary, the data provide evidence of an excess of premature deaths among left handers from warfare, but no changes in mortality from non-violent causes. Whether the increase in unnatural deaths is the result of circumstances peculiar to the last few generations is difficult to determine. Nevertheless, in most popu-

lations where such unnatural deaths are rare, or absent, there will be no handedness effect. This seems to be borne out by the preliminary findings of current longitudinal surveys.[10 22 23]

We thank P Bailey, M Ferguson, and D Altman for their help.

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Colour blind cricketers and snowballs

Nicholas Goddard, Dominic Coull

Abstract

***Objective*—To determine whether colour blindness affects batting in professional cricketers.**

***Design*—Comparison of batting averages of colour blind cricketers and those with normal vision.**

***Setting*—Players on 18 first class county cricket teams.**

***Subjects*—280 of 306 players were tested.**

***Main outcome measures*—Results of Isihara colour blindness tests.**

***Results*—Batting average for the colour blind group (12 players) was slightly lower than for players with normal vision (20·88 *v* 26·31).** There was no difference in the number of batsmen and bowlers affected. Batting averages before and after the introduction of the white ball into Sunday League cricket did not differ significantly.

***Conclusions*—That batting performance is not significantly impaired by colour blindness suggests that to some extent these players are self selected. Routine testing of cricketers for colour blindness is not recommended.**

Royal Free Hospital and School of Medicine, London NW3 2QG
Nicholas Goddard, *consultant orthopaedic surgeon*
Dominic Coull, *medical student*

Correspondence to:
Mr Goddard.

BMJ 1994;309:1684-5

Introduction

This study was motivated by the senior author's red-green colour blindness, coupled with his singular lack of ability to hit a (red) cricket ball moving at speed. As he is able to hit a white rounders ball or baseball or a black squash ball with some degree of accuracy and reliability, it must be assumed that colour blindness has some role. If red-green colour blindness alone caused this inability a similar visual handicap in professional cricketers could adversely affect batting performances, especially with a red cricket ball—travelling at 80 mph (130 km/hour) or more—rising off a lush green wicket.

The study aimed to determine the prevalence of red-green colour blindness in a group of professional cricketers. Four questions were to be answered:
(1) Are cricketers less likely to be colour blind than men in the general population?
(2) Are batsmen less likely to be colour blind than bowlers?
(3) Does colour blindness affect batting ability?
(4) Would introducing a white ball into Sunday League cricket make any difference to colour blind players?

Methods

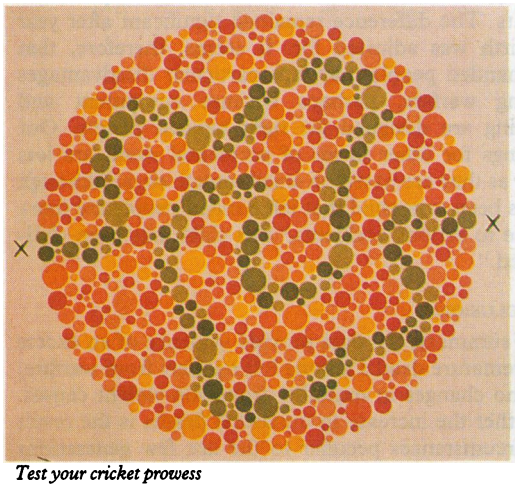
During the course of the 1993 cricket season the playing staff of every first class county side (18 teams) were tested for red-green colour blindness by using standard Ishihara test charts. No additional tests of visual acuity or depth of vision were carried out. When appropriate, players wore their normal contact lenses or spectacles. We were able to test 280 cricketers of the 306 listed, which represents 92% of the playing population.

To assess the influence of the white ball we compared the batting averages of colour blind players in the AXA Equity and Law Sunday League in the two seasons before and after its introduction.

Results

Eight per cent of men in the general population are red-green colour blind.[1] Of the 280 players we tested, 12 (4%) had red-green colour blindness. This difference is statistically significant ($z=3{\cdot}053$; $P=0{\cdot}0023$).

The players affected reflected the composition of normal cricket team (and 12th man)—five were predominantly batsmen, two were all-rounders, one was a wicket keeper, and four were predominantly bowlers.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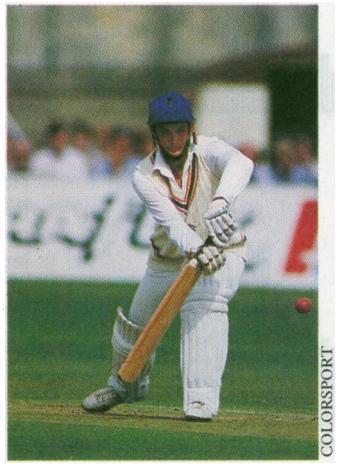
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